

What is claimed is:

1. A method of cleaning a substrate comprising:

applying an aqueous sulfuric acid solution diluted by deionized water onto the
5 substrate; and

cleaning contaminants on the substrate in accordance with a reaction between
the diluted aqueous sulfuric acid solution with the contaminants by applying a
mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution.

10 2. The method of claim 1, wherein the substrate includes a metal wiring or a
metal thin film.

3. The method of claim 1, wherein the diluted aqueous sulfuric acid solution
comprises the deionized water and sulfuric acid by a volume ratio of about 500: 1 to
15 about 8,000: 1.

4. The method of claim 3, wherein the sulfuric acid has a concentration of
about 10 ppm to about 1,000 ppm.

20 5. The method of claim 1, wherein the mega-sonic energy is generated using
a power of about 5 Watts to about 15 Watts.

6. The method of claim 1, wherein cleaning the contaminants is performed
for about 30 seconds to about 120 seconds.

7. The method of claim 6, wherein cleaning the contaminants is performed at a temperature of about 20 degrees C to about 30 degrees C.

5 8. The method of claim 1, wherein cleaning the contaminants is performed using a spin scrubber.

9. The method of claim 8, wherein the substrate is provided into the spin scrubber in a batch type, the diluted aqueous sulfuric solution is applied by a spray
10 process, and the mega-sonic energy is applied through a bar facing the substrate.

10. The method of claim 8, wherein the substrate rotates at a speed of about 8 rpm to about 50 rpm.

15 11. The method of claim 1, further comprising rinsing the substrate using deionized water, and drying the substrate.

12. A method of cleaning a substrate comprising:
providing an aqueous sulfuric acid solution diluted by deionized water in a bath;
20 immersing the substrate into the diluted aqueous sulfuric acid solution; and
cleaning contaminants on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution.

13. The method of claim 12, wherein the diluted aqueous sulfuric acid solution comprises the deionized water and sulfuric acid by a volume ratio of about 500: 1 to about 8,000: 1.

5 14. The method of claim 12, wherein the sulfuric acid has a concentration of about 10 ppm to about 1,000 ppm.

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